THE LANCET
Infectious Diseases

Supplementary appendix

This appendix formed part of the original submission and has been peer reviewed. We post it as supplied by the authors.

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Supplementary Appendix

Supplementary Methods

Study Design

A test negative case control design was used to estimate vaccine effectiveness against symptomatic disease and hospitalisation with Omicron sub-lineages BA.1 and BA.2 in individuals aged 18 years and older. The odds of vaccination in symptomatic PCR positive cases was compared to the odds of vaccination in symptomatic individuals who tested negative for SARS-CoV-2 in England.

Data Sources

COVID-19 Testing Data

SARS-CoV-2 Testing PCR testing for SARS CoV-2 in England is undertaken by hospital and public health laboratories (Pillar 1), as well as by community testing (Pillar 2). Pillar 2 testing is available to anyone with symptoms consistent with COVID-19 (high temperature, new continuous cough, or loss or change in sense of smell or taste), anyone who is a contact of a confirmed case, care home staff and residents, and to those who have self-tested as positive using a lateral flow test (LFT). Data on all positive PCR and LFTs, and on negative Pillar 2 PCR tests from symptomatic individuals with a test date after 25 November 2020 were extracted up to 31 March 2022. Individuals who reported symptoms and were tested in Pillar 2 between 17 January 2022 and 31 March 2022 were included in the analysis to estimate VE against symptomatic disease (Supplementary Figure 1). Any negative tests taken within 7 days of a previous negative test, and any negative tests where symptom onset date was within the 10 days or a previous symptoms onset date for a negative test were dropped as these likely represent the same episode. Negative tests taken within 21 days of a subsequent positive test were also excluded as chances are high that these are false negatives. Positive and negative tests within 90 days of a previous positive test were also excluded; however, where participants had later positive tests within 14 days of a positive then preference was given to PCR tests and symptomatic tests. For individuals who had more than one negative test, one was selected at random in the study period. Data were restricted to persons who had reported symptoms and gave a symptom onset date within the 10 days before testing to account for reduced PCR sensitivity beyond this period in an infection event.

Vaccination Data

The National Immunization Management System (NIMS) contains demographic information on the whole population of England who are registered with a general practice physician in England and is used to record all COVID-19 vaccinations. NIMS was accessed for dates of vaccination and manufacturer, sex, date of birth, ethnicity, and residential address. Addresses were used to determine index of multiple deprivation quintile and were also linked to Care Quality Commission registered care homes using the unique property reference number. Data on geography (NHS region), risk group status, clinically extremely vulnerable status, and health/social care worker were also extracted from the NIMS. Clinical risk groups included a range of chronic conditions as described in the Green Book (1), whereas the clinically extremely vulnerable group included persons who were considered to be at the highest risk for severe COVID-19, including those with immunosuppressed conditions and those with severe respiratory disease. Booster doses were identified as a third dose given at least 84 days after a second dose and administered after 13 September 2021. Individuals

with four or more doses of vaccine, heterologous primary schedule or fewer than 19 days between their first and second dose were excluded.

Testing data were linked to NIMS on 4 March 2022 using combinations of the unique individual National Health Service (NHS) number, date of birth, surname, first name, and postcode using deterministic linkage – 99.6% of eligible tests could be linked to the NIMS.

Identification of Delta and Omicron Variants and assignment to cases

Sequencing of PCR positive samples is undertaken through a network of laboratories, including the Wellcome Sanger Institute. Whole-genome sequences are assigned to UKHSA definitions of variants based on mutations (2). S-gene target status on PCR-testing is an alternative approach for identifying each sub-lineage because BA.1 has been associated with S-gene target failure on PCR testing with the Taqpath assay while BA.2 has been associated with a positive S-gene target. Cases were defined as BA.1 or BA.2 based on whole genome sequencing or S-gene target status, with sequencing taking priority. Where subsequent positive tests within 14 days included sequencing or S-gene target failure information, this information was used to classify the variant.

Hospital Admission Data

SUS is the national electronic database of hospital admissions that provides timely updates of ICD-10 codes for completed hospital stays for all NHS hospitals in England. Up to 24 ICD-10 diagnoses fields can be completed in SUS for each admission with the first diagnosis field indicating the primary reason for admission. Hospital inpatient admissions for a range of acute respiratory illnesses were identified from SUS and were linked to the testing data on 4 March 2022 using NHS number and date of birth as previously described (3). For the Pillar 2 samples, admissions with an ICD-10 acute respiratory illness (ARI) discharge diagnosis in the first diagnosis field were identified where the sample was taken 14 days before and up to 2 days after the day of admission. For the Pillar 1 samples, admissions with an ICD-10 coded ARI discharge diagnosis in any diagnosis field were identified where the sample was taken 1 day before and up to 2 days after the admission. Length of stay was calculated as date of discharge – date of admission. Where multiple admissions linked to the same sample date the first admission after the sample date was retained and episode length calculated by summing the stay length for each admission. Data were restricted to those with ARI in the first diagnosis field and where the length of stay was at least two days. The data was restricted to tests up to 16 March 2022 to account for delays in the SUS data recording.

Control selection

For analyses involving hospitalised controls any negative tests that led to a hospitalisation within 21 days of a previous hospital negative test were excluded. A maximum of one negative test per person within each of the following approximate 3-month periods was selected at random: 26 April to 1 August 2021, 2 August 2021 to 21 November 2021, 22 November 2021 to 16 March 2022. For analyses involving all Pillar 2 symptomatic controls the same was done within this control group.

Statistical Analysis

Logistic regression was used, with the PCR test result as the dependent variable and cases being those testing positive (stratified in separate analyses as either BA.1 or BA.2) and controls being those testing negative. Vaccination status was included as an independent variable and effectiveness defined as 1- odds of vaccination in cases/odds of vaccination in controls.

Vaccine effectiveness was adjusted in logistic regression models for age (ages 18-19, then 20 through to 89 in five-year bands, then everyone age 90 years or older), sex, index of multiple

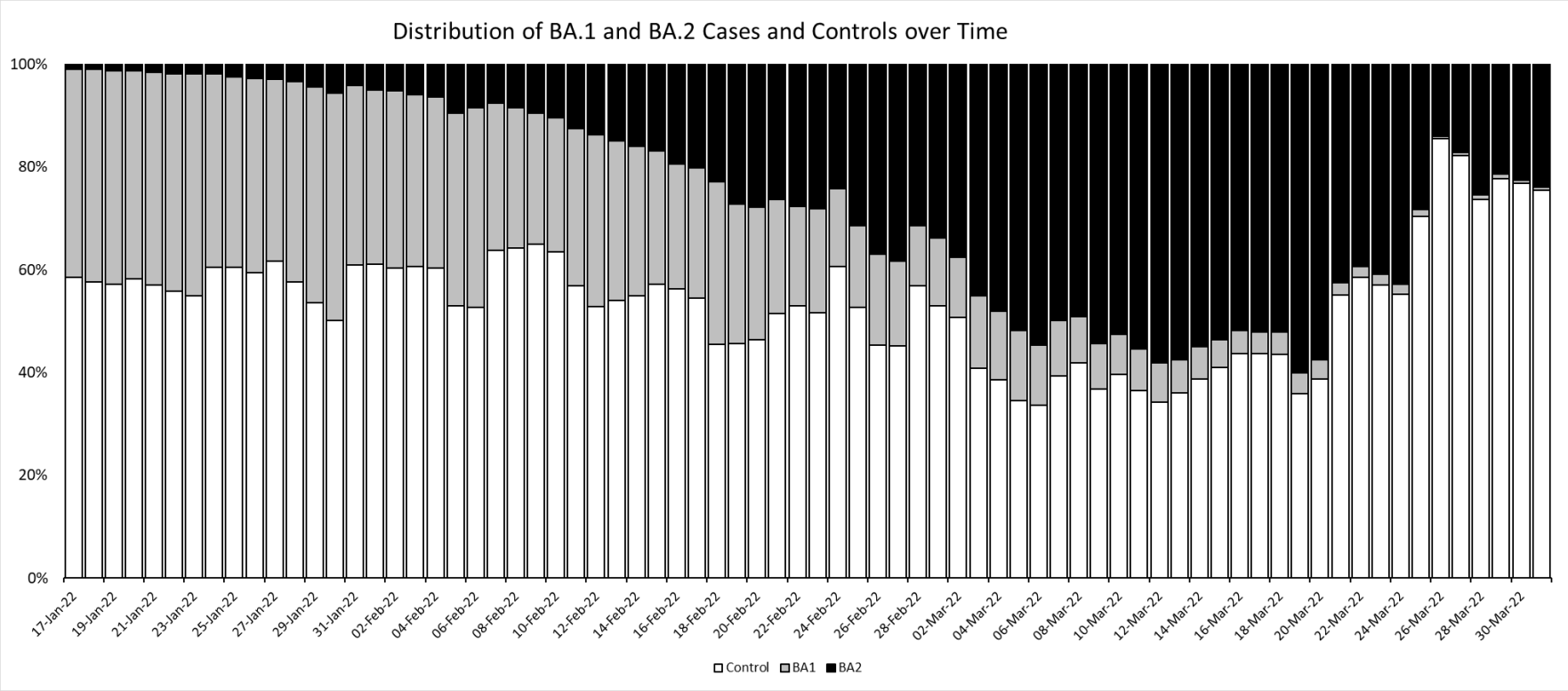
deprivation (quintile), ethnic group, history of travel, geographic region (NHS region), period (week of test), health and social care worker status, clinical risk group status, clinically extremely vulnerable, and previously testing positive. These factors were all considered potential confounders so were included in all models.

Analysis combined all vaccine manufacturers (ChAdOx1, BNT162b2 or mRNA-1273 for one dose or two doses, and BNT162b2 or mRNA-1273 (half-dose) for booster doses). Heterologous primary schedules and ChAdOx1 primary course followed by ChAdOx1 booster dose recipients were excluded.

Vaccine effectiveness was assessed in intervals of less than 4 weeks and 4 or more weeks post the first dose; less than 2 weeks, 2 to 24 weeks, and 25 or more weeks post the second dose; and less than 1 week, 1 week, 2 to 4 weeks, 5 to 9 weeks, 10 to 14 weeks and 15 or more weeks post a booster dose.

Supplementary Tables and Figures

Supplementary Figure 1. The distribution of eligible tests from BA.1 cases, BA.2 cases and controls over time.



Supplementary Table 1. Descriptive characteristics of eligible tests from symptomatic individuals.

			Overall		Negative		BA.1		BA.2	
			n	%	n	%	n	%	n	%
	Test Result	**Interval (weeks)**	**1,127,517**	**100.0%**	**615,628**	**54.6%**	**265,820**	**23.6%**	**246,069**	**21.8%**
Vaccination Status and intervals after vaccine	Unvaccinated		97,073	**8.6%**	37,280	**6.1%**	33,961	**12.8%**	25,832	**10.5%**
	Dose 1*	<4	3,681	**0.3%**	2,086	**0.3%**	1,229	**0.5%**	366	**0.1%**
		4+	27,639	**2.5%**	14,414	**2.3%**	7,608	**2.9%**	5,617	**2.3%**
	Dose 2*	<2	1,824	**0.2%**	1,189	**0.2%**	434	**0.2%**	201	**0.1%**
		2-24	75,122	**6.7%**	39,555	**6.4%**	25,444	**9.6%**	10,123	**4.1%**
		25+	106,940	**9.5%**	46,958	**7.6%**	33,616	**12.6%**	26,366	**10.7%**
	Booster**	<1	4,969	**0.4%**	2,751	**0.4%**	1,785	**0.7%**	433	**0.2%**
		1	7,909	**0.7%**	5,541	**0.9%**	1,989	**0.7%**	379	**0.2%**
		2-4	74,934	**6.6%**	51,990	**8.4%**	20,352	**7.7%**	2,592	**1.1%**
		5-9	261,881	**23.2%**	168,627	**27.4%**	67,466	**25.4%**	25,788	**10.5%**
		10-14	257,056	**22.8%**	143,890	**23.4%**	43,743	**16.5%**	69,423	**28.2%**
		15+	208,489	**18.5%**	101,347	**16.5%**	28,193	**10.6%**	78,949	**32.1%**
Age	18-19		27,899	**2.5%**	16,920	**2.7%**	6,700	**2.5%**	4,279	**1.7%**
	20-24		95,001	**8.4%**	55,013	**8.9%**	22,282	**8.4%**	17,706	**7.2%**
	25-29		128,276	**11.4%**	71,663	**11.6%**	30,575	**11.5%**	26,038	**10.6%**
	30-34		152,790	**13.6%**	84,679	**13.8%**	37,286	**14.0%**	30,825	**12.5%**
	35-39		151,014	**13.4%**	82,908	**13.5%**	38,371	**14.4%**	29,735	**12.1%**
	40-44		132,936	**11.8%**	72,227	**11.7%**	33,595	**12.6%**	27,114	**11.0%**
	45-49		111,498	**9.9%**	60,768	**9.9%**	26,680	**10.0%**	24,050	**9.8%**
	50-54		101,049	**9.0%**	54,411	**8.8%**	22,686	**8.5%**	23,952	**9.7%**
	55-59		83,166	**7.4%**	43,718	**7.1%**	18,243	**6.9%**	21,205	**8.6%**
	60-64		58,454	**5.2%**	30,392	**4.9%**	12,371	**4.7%**	15,691	**6.4%**
	65-69		36,142	**3.2%**	19,207	**3.1%**	7,020	**2.6%**	9,915	**4.0%**
	70-74		25,386	**2.3%**	12,678	**2.1%**	5,001	**1.9%**	7,707	**3.1%**
	75-79		12,507	**1.1%**	5,877	**1.0%**	2,509	**0.9%**	4,121	**1.7%**
	80-84		5,977	**0.5%**	2,732	**0.4%**	1,243	**0.5%**	2,002	**0.8%**
	85-89		3,358	**0.3%**	1,581	**0.3%**	725	**0.3%**	1,052	**0.4%**
	>=90		2,064	**0.2%**	854	**0.1%**	533	**0.2%**	677	**0.3%**
Gender	Female		698,771	**62.0%**	392,185	**63.7%**	161,032	**60.6%**	145,554	**59.2%**
	Male		426,669	**37.8%**	222,247	**36.1%**	104,335	**39.3%**	100,087	**40.7%**
	Missing		2,077	**0.2%**	1,196	**0.2%**	453	**0.2%**	428	**0.2%**
Ethnicity	African		11,893	**1.1%**	6,669	**1.1%**	2,874	**1.1%**	2,350	**1.0%**
	Any other Asian background		20,519	**1.8%**	11,198	**1.8%**	5,012	**1.9%**	4,309	**1.8%**
	Any other Black background		4,979	**0.4%**	2,666	**0.4%**	1,261	**0.5%**	1,052	**0.4%**
	Any other White background		104,522	**9.3%**	48,961	**8.0%**	30,267	**11.4%**	25,294	**10.3%**
	Any other ethnic group		23,244	**2.1%**	12,147	**2.0%**	6,138	**2.3%**	4,959	**2.0%**
	Any other mixed background		7,602	**0.7%**	4,104	**0.7%**	1,851	**0.7%**	1,647	**0.7%**
	Bangladeshi or British Bangladeshi		6,675	**0.6%**	3,614	**0.6%**	1,884	**0.7%**	1,177	**0.5%**
	British, Mixed British		758,109	**67.2%**	422,599	**68.6%**	170,317	**64.1%**	165,193	**67.1%**
	Caribbean		5,513	**0.5%**	2,662	**0.4%**	1,511	**0.6%**	1,340	**0.5%**

	Chinese	8,257	**0.7%**	4,695	**0.8%**	1,634	**0.6%**	1,928	**0.8%**
	Indian or British Indian	35,501	**3.1%**	20,720	**3.4%**	7,890	**3.0%**	6,891	**2.8%**
	Irish	6,966	**0.6%**	3,949	**0.6%**	1,347	**0.5%**	1,670	**0.7%**
	Pakistani or British Pakistani	21,393	**1.9%**	11,538	**1.9%**	7,226	**2.7%**	2,629	**1.1%**
	White and Asian	3,813	**0.3%**	2,198	**0.4%**	848	**0.3%**	767	**0.3%**
	White and Black African	2,487	**0.2%**	1,331	**0.2%**	636	**0.2%**	520	**0.2%**
	White and Black Caribbean	3,515	**0.3%**	1,808	**0.3%**	924	**0.3%**	783	**0.3%**
	Missing	102,529	**9.1%**	54,769	**8.9%**	24,200	**9.1%**	23,560	**9.6%**
NHS Region	East of England	154,515	**13.7%**	78,286	**12.7%**	39,259	**14.8%**	36,970	**15.0%**
	London	171,459	**15.2%**	89,904	**14.6%**	38,884	**14.6%**	42,671	**17.3%**
	Midlands	192,043	**17.0%**	107,429	**17.5%**	49,114	**18.5%**	35,500	**14.4%**
	North East	169,333	**15.0%**	86,652	**14.1%**	48,948	**18.4%**	33,733	**13.7%**
	North West	154,894	**13.7%**	68,188	**11.1%**	42,397	**15.9%**	44,309	**18.0%**
	South East	175,219	**15.5%**	110,444	**17.9%**	29,893	**11.2%**	34,882	**14.2%**
	South West	110,050	**9.8%**	74,722	**12.1%**	17,325	**6.5%**	18,003	**7.3%**
	Missing	4	**0.0%**	3	**0.0%**	0	**0.0%**	1	**0.0%**
IMD Quintiles	1	193,641	**17.2%**	95,522	**15.5%**	58,316	**21.9%**	39,803	**16.2%**
	2	220,423	**19.5%**	117,642	**19.1%**	54,900	**20.7%**	47,881	**19.5%**
	3	231,790	**20.6%**	127,715	**20.7%**	53,007	**19.9%**	51,068	**20.8%**
	4	237,148	**21.0%**	132,810	**21.6%**	51,106	**19.2%**	53,232	**21.6%**
	5	240,195	**21.3%**	139,536	**22.7%**	47,446	**17.8%**	53,213	**21.6%**
	Missing	4,320	**0.4%**	2,403	**0.4%**	1,045	**0.4%**	872	**0.4%**
Vaccine priority groups	HSCW	99,072	**8.8%**	55,519	**9.0%**	20,997	**7.9%**	22,556	**9.2%**
	At risk***	227,307	**20.2%**	123,424	**20.0%**	53,886	**20.3%**	49,997	**20.3%**
	CEV	73,997	**6.6%**	36,067	**5.9%**	18,517	**7.0%**	19,413	**7.9%**
	Severely Immunosuppressed	12,785	**1.1%**	4,718	**0.8%**	3,440	**1.3%**	4,627	**1.9%**
Previously positive	No	935,434	**83.0%**	484,592	**78.7%**	235,170	**88.5%**	215,672	**87.6%**
	Yes	192,083	**17.0%**	131,036	**21.3%**	30,650	**11.5%**	30,397	**12.4%**

*Dose 1 and 2 is recipients of ChAdOx1-S, BNT162b2 or mRNA-1273.

**Booster is recipients of BNT162b2 or mRNA-1273 following any primary immunisation course.

***At risk is only those under 65

Supplementary Table 2. Descriptive characteristics of eligible tests from hospitalised individuals.

			Overall		Negative		BA.1		BA.2	
			n	%	n	%	n	%	n	%
	Test Result	**Interval (weeks)**	**15,043**	**100.0%**	**12,758**	**84.8%**	**1,662**	**11.0%**	**623**	**4.1%**
Vaccination Status and intervals after vaccine	Unvaccinated		940	**6.2%**	601	**4.7%**	274	**16.5%**	65	**10.4%**
	Dose 1*	<4	20	**0.1%**	14	**0.1%**	6	**0.4%**	0	**0.0%**
		4+	301	**2.0%**	217	**1.7%**	65	**3.9%**	19	**3.0%**
	Dose 2*	<2	4	**0.0%**	4	**0.0%**	0	**0.0%**	0	**0.0%**
		2-24	190	**1.3%**	162	**1.3%**	25	**1.5%**	3	**0.5%**
		25+	1,270	**8.4%**	962	**7.5%**	240	**14.4%**	68	**10.9%**
	Booster**	<1	54	**0.4%**	45	**0.4%**	9	**0.5%**	0	**0.0%**
		1	62	**0.4%**	54	**0.4%**	7	**0.4%**	1	**0.2%**
		2-4	396	**2.6%**	362	**2.8%**	31	**1.9%**	3	**0.5%**
		5-9	2,195	**14.6%**	2,019	**15.8%**	159	**9.6%**	17	**2.7%**
		10-14	4,566	**30.4%**	4,055	**31.8%**	403	**24.2%**	108	**17.3%**
		15+	5,045	**33.5%**	4,263	**33.4%**	443	**26.7%**	339	**54.4%**
Age	18-19		32	**0.2%**	25	**0.2%**	4	**0.2%**	3	**0.5%**
	20-24		102	**0.7%**	67	**0.5%**	25	**1.5%**	10	**1.6%**
	25-29		144	**1.0%**	89	**0.7%**	38	**2.3%**	17	**2.7%**
	30-34		194	**1.3%**	111	**0.9%**	64	**3.9%**	19	**3.0%**
	35-39		218	**1.4%**	158	**1.2%**	43	**2.6%**	17	**2.7%**
	40-44		238	**1.6%**	178	**1.4%**	44	**2.6%**	16	**2.6%**
	45-49		335	**2.2%**	282	**2.2%**	40	**2.4%**	13	**2.1%**
	50-54		492	**3.3%**	384	**3.0%**	78	**4.7%**	30	**4.8%**
	55-59		644	**4.3%**	548	**4.3%**	80	**4.8%**	16	**2.6%**
	60-64		896	**6.0%**	757	**5.9%**	104	**6.3%**	35	**5.6%**
	65-69		1,286	**8.5%**	1,109	**8.7%**	125	**7.5%**	52	**8.3%**
	70-74		1,707	**11.3%**	1,461	**11.5%**	175	**10.5%**	71	**11.4%**
	75-79		2,073	**13.8%**	1,778	**13.9%**	210	**12.6%**	85	**13.6%**
	80-84		2,369	**15.7%**	2,058	**16.1%**	218	**13.1%**	93	**14.9%**
	85-89		2,333	**15.5%**	2,041	**16.0%**	213	**12.8%**	79	**12.7%**
	>=90		1,980	**13.2%**	1,712	**13.4%**	201	**12.1%**	67	**10.8%**
Gender	Female		7,405	**49.2%**	6,260	**49.1%**	837	**50.4%**	308	**49.4%**
	Male		7,554	**50.2%**	6,414	**50.3%**	825	**49.6%**	315	**50.6%**
	Missing		0	**0.0%**	0	**0.0%**	0	**0.0%**	0	**0.0%**
Ethnicity	African		107	**0.7%**	79	**0.6%**	22	**1.3%**	6	**1.0%**
	Any other Asian background		121	**0.8%**	92	**0.7%**	25	**1.5%**	4	**0.6%**
	Any other Black background		48	**0.3%**	34	**0.3%**	11	**0.7%**	3	**0.5%**
	Any other White background		691	**4.6%**	541	**4.2%**	107	**6.4%**	43	**6.9%**
	Any other ethnic group		155	**1.0%**	119	**0.9%**	23	**1.4%**	13	**2.1%**
	Any other mixed background		43	**0.3%**	30	**0.2%**	11	**0.7%**	2	**0.3%**
	Bangladeshi or British Bangladeshi		66	**0.4%**	44	**0.3%**	18	**1.1%**	4	**0.6%**
	British, Mixed British		12,290	**81.7%**	10,608	**83.1%**	1,210	**72.8%**	472	**75.8%**
	Caribbean		102	**0.7%**	68	**0.5%**	30	**1.8%**	4	**0.6%**

	Chinese	38	**0.3%**	23	**0.2%**	12	**0.7%**	3	**0.5%**
	Indian or British Indian	292	**1.9%**	228	**1.8%**	49	**2.9%**	15	**2.4%**
	Irish	157	**1.0%**	134	**1.1%**	12	**0.7%**	11	**1.8%**
	Pakistani or British Pakistani	224	**1.5%**	169	**1.3%**	46	**2.8%**	9	**1.4%**
	White and Asian	8	**0.1%**	6	**0.0%**	1	**0.1%**	1	**0.2%**
	White and Black African	15	**0.1%**	11	**0.1%**	4	**0.2%**	0	**0.0%**
	White and Black Caribbean	26	**0.2%**	16	**0.1%**	4	**0.2%**	6	**1.0%**
	Missing	660	**4.4%**	556	**4.4%**	77	**4.6%**	27	**4.3%**
NHS Region	East of England	1,323	**8.8%**	1,135	**8.9%**	127	**7.6%**	61	**9.8%**
	London	1,618	**10.8%**	1,248	**9.8%**	258	**15.5%**	112	**18.0%**
	Midlands	3,443	**22.9%**	2,997	**23.5%**	326	**19.6%**	120	**19.3%**
	North East	2,627	**17.5%**	2,331	**18.3%**	234	**14.1%**	62	**10.0%**
	North West	2,334	**15.5%**	1,940	**15.2%**	321	**19.3%**	73	**11.7%**
	South East	2,181	**14.5%**	1,817	**14.2%**	247	**14.9%**	117	**18.8%**
	South West	1,517	**10.1%**	1,290	**10.1%**	149	**9.0%**	78	**12.5%**
	Missing	0	**0.0%**	0	**0.0%**	0	**0.0%**	0	**0.0%**
IMD Quintiles	1	3,618	**24.1%**	3,075	**24.1%**	443	**26.7%**	100	**16.1%**
	2	3,110	**20.7%**	2,609	**20.4%**	361	**21.7%**	140	**22.5%**
	3	2,900	**19.3%**	2,454	**19.2%**	313	**18.8%**	133	**21.3%**
	4	2,870	**19.1%**	2,455	**19.2%**	293	**17.6%**	122	**19.6%**
	5	2,516	**16.7%**	2,142	**16.8%**	246	**14.8%**	128	**20.5%**
	Missing	0	**0.0%**	0	**0.0%**	0	**0.0%**	0	**0.0%**
Vaccine priority groups	HSCW	87	**0.6%**	56	**0.4%**	23	**1.4%**	8	**1.3%**
	At risk***	2,387	**15.9%**	1,920	**15.0%**	347	**20.9%**	120	**19.3%**
	Severely Immunosuppressed	1,440	**9.6%**	1,102	**8.6%**	259	**15.6%**	79	**12.7%**
	CEV	7,659	**50.9%**	6,399	**50.2%**	942	**56.7%**	318	**51.0%**
Previously positive	No	13,366	**88.9%**	11,185	**87.7%**	1,579	**95.0%**	602	**96.6%**
	Yes	1,677	**11.1%**	1,573	**12.3%**	83	**5.0%**	21	**3.4%**
Pillar	1	14,065	**93.5%**	12,528	**98.2%**	1,071	**64.4%**	466	**74.8%**
	2	978	**6.5%**	230	**1.8%**	591	**35.6%**	157	**25.2%**

*Dose 1 and 2 is recipients of ChAdOx1-S, BNT162b2 or mRNA-1273.

**Booster is recipients of BNT162b2 or mRNA-1273 following any primary immunisation course.

***At risk is only those under 65

Supplementary Table 3. Vaccine effectiveness estimates against symptomatic disease for individuals aged 18 years and older in England.

			BA.1		BA.2	
Doses	Interval (weeks)	Controls	Cases	VE (95% CI)	Cases	VE (95% CI)
Unvaccinated		37,280	33961	Baseline	25832	Baseline
Dose 1*	<4	2,086	1229	44.6 (40.3-48.6)	366	53.3 (46.9-58.9)
	4+	14,414	7608	38.6 (36.4-40.6)	5617	44.5 (42.2-46.7)
Dose 2*	<2	1,189	434	63.1 (58.5-67.1)	201	64.3 (57.7-69.9)
	2-24	39,555	25444	34.9 (33.4-36.5)	10123	44.9 (43.1-46.6)
	25+	46,958	33616	14.8 (12.9-16.7)	26366	27.8 (25.9-29.7)
Booster**	<1	2,751	1785	44.3 (40.6-47.8)	433	51.2 (45.1-56.6)
	1	5,541	1989	70.6 (68.9-72.2)	379	74.0 (70.8-76.9)
	2-4	51,990	20352	68.7 (68.0-69.5)	2592	74.1 (72.9-75.3)
	5-9	168627	67466	63.5 (62.8-64.2)	25788	66.1 (65.2-66.9)
	10-14	143890	43743	53.0 (52.0-54.1)	69423	59.4 (58.5-60.3)
	15+	101347	28193	37.4 (35.8-39.0)	78949	43.7 (42.3-45.1)

*Dose 1 and 2 is recipients of ChAdOx1-S, BNT162b2 or mRNA-1273.
**Booster is recipients of BNT162b2 or mRNA-1273 following any primary immunisation course.

Supplementary Table 4. Vaccine effectiveness estimates against hospitalisation for individuals aged 18 years and older in England.

			BA.1		BA.2	
Doses	Interval (weeks)	Controls	Cases	VE (95% CI)	Cases	VE (95% CI)
Unvaccinated		601	274	baseline	65	baseline
Dose 1*	<4	14	6	n/a	0	n/a
	4+	217	65	29.8 (-0.2-50.8)	19	12.5 (-60.1-52.2)
Dose 2*	<2	4	0	n/a	0	n/a
	2-24	162	25	76.1 (59.3-86.0)	3	86.3 (52.8-96.0)
	25+	962	240	50.6 (37.7-60.8)	68	25.9 (-11.1-50.6)
Booster**	<1	45	9	60.9 (12.3-82.5)	0	n/a
	1	54	7	82.7 (56.9-93.0)	1	59.7 (-216-94.9)
	2-4	362	31	90.8 (85.1-94.3)	3	82.8 (41.9-94.9)
	5-9	2,019	159	89.1 (85.9-91.5)	17	89.1 (80.5-94.0)
	10-14	4,055	403	85.4 (81.9-88.2)	108	70.2 (56.8-79.5)
	15+	4,263	443	80.4 (75.6-84.3)	339	56.5 (38.4-69.3)

*Dose 1 and 2 is recipients of ChAdOx1-S, BNT162b2 or mRNA-1273.
**Booster is recipients of BNT162b2 or mRNA-1273 following any primary immunisation course.

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